Interfacial Biocatalytic Performance of Nanofiber-Supported β-Galactosidase for Production of Galacto-Oligosaccharides

ABSTRACT

Molecular distribution, structural conformation and catalytic activity at the interface between enzyme and its immobilising support are vital in the enzymatic reactions for producing bioproducts. In this study, a nanobiocatalyst assembly, β-galactosidase immobilized on chemically modified electrospun polystyrene nanofibers (PSNF), was synthesized for converting lactose into galacto-oligosaccharides (GOS). Characterization results using scanning electron microscopy (SEM) and fluorescence analysis of fluorescein isothiocyanat (FITC) labelled β-galactosidase revealed homogenous enzyme immobilization, thin layer structural conformation and biochemical functionalities of the nanobiocatalyst assembly. The β-galactosidase/PSNF assembly displayed enhanced enzyme catalytic performance at are sidence time of around 1 min in a disc-stacked column reactor. A GOS yield of 41% and a lactose conversion of 88% was achieved at the initial lactose concentration of 300 g/L at this residence time. This system provided a controllable contact time of products and substrates on the nanofiber surface and could be used for products which are sensitive to the duration of nanobiocatalysis.